Sector
Buildings, Energy Efficiency, and Demand-Side Management

Strategy/Policy
All Cost Effective Energy Efficiency

Methodology and Data Sources for GHG Emission Reduction Calculation

$$M_n = \underbrace{\left[\sum_{i=2010}^{n} (Z_{i,elec.})(A_{elec.})(C_1)\right]}_{\text{GHG mitigated from electricity savings}} + \underbrace{\left[\sum_{i=2010}^{n} (Z_{i,gas})(A_{gas})(C_2)\right]}_{\text{GHG mitigated from natural gas savings}} + \underbrace{\left[\sum_{i=2010}^{n} (Z_{i,oil})(A_{oil})(C_1)\right]}_{\text{GHG mitigated from oil savings}} + \underbrace{\left[\sum_{i=2010}^{n} (Z_{i,propane})(A_{propane})(C_1)\right]}_{\text{GHG mitigated from propane savings}}$$

where:

Symbol	Value	Unit	Description	Data Source & Assumption
M_n	(calculated)	$MMTCO_2e$	mitigation in year n	(see below)
$Z_{i,elec.}$	(depends on year i)	MWh	annual electric savings for year i, net of electric and gas plans savings	Annual results supplied by Rich May LLC on 11/18/13 by Energy Efficiency Program Administrators, less the amount included in the Business-As-Usual projection (baseline). Assumed energy efficiency measures have an average life-span of 11 years.
$Z_{i,gas}$	(depends on year i)	therms	annual natural gas savings for year i, net of electric and gas plans savings	
$Z_{i,oil}$	(depends on year i)	mmBtu	annual oil savings for year i	
$Z_{i,propane}$	(depends on year i)	mmBtu	annual propane savings for year i	
$A_{elec.}$	1030	lb CO_2/MWh	emission factor for electricity savings	2010 New England Average Avoided CO2 Emissions, average for New England, average for winter & summer (AESC 2009, Exhibit 6-47).
A_{gas}	0.00585	short ton CO_2/therm	emission factor for natural gas savings	http://www.epa.gov/cleanenergy/energy-resources/refs.html 0.1 mmBtu/1 therm * 14.47 kg C/mmBtu * 44 g CO_2/12 g C * 1 metric ton/1000 kg * 1.1023 metric ton/short ton = 0.00585 short tons CO_2/therm
A_{oil}	161.386	lb CO_2/mmBtu	emission factor for oil savings	US Energy Information Administration, Table A.3. Carbon Dioxide Uncontrolled Emission Factors Distillate Fuel Oil http://www.eia.gov/electricity/annual/html/epa_a_03.html

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Symbol	Value	Unit	Description	Data Source & Assumption
$A_{propane}$	139.178	lb CO_2/mmBtu	emission factor for propane savings	US Energy Information Administration, Table A.3. Carbon Dioxide Uncontrolled Emission Factors Propane Gas http://www.eia.gov/electricity/annual/html/epa_a_03.html
C_1	4.53592E-10	MMT/lb	conversion factor to convert pounds of CO_2 into million metric ton of CO_2e ($MMTCO_2e$)	Assumed minimal or no significant emission from other gases, besides carbon dioxide (CO_2), with global warming potential.
C_2	9.07185E-7	MMT/short ton	conversion factor to convert short ton of CO_2 into $MMTCO_2e$	